

**INDUSTRIAL INTERNET OF THINGS
(AEIE 5243)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which protocol is NOT commonly used for communication in IIoT systems?
(a) CoAP (b) MQTT (c) HTTP (d) FTP.
- (ii) What is a major challenge related to cellular communication in IIoT
(a) High data transfer speeds (b) Low power consumption
(c) Network coverage and latency issues (d) Lack of global standardization.
- (iii) What is the primary role of a PAN coordinator in a peer-to-peer IIoT network?
(a) To act as a bridge between different networks
(b) To manage communication and synchronization within the network
(c) To provide cloud-based services to the network
(d) To act as a security firewall.
- (iv) Which of the following is a key characteristic of a peer-to-peer communication network?
(a) Centralized control
(b) Direct communication between devices
(c) Requires an internet connection
(d) Only supports wired communication.
- (v) Which of the following is NOT an application of the ZigBee network?
(a) Home automation (b) Industrial monitoring
(c) High-speed video streaming (d) Smart metering.
- (vi) How many classes of Bluetooth radios exist based on power consumption and range?
(a) One (b) Two (c) Three (d) Four.
- (vii) Which feature differentiates NB-IoT from LoRa?
(a) LoRa has higher data rates
(b) NB-IoT operates on licensed spectrum
(c) NB-IoT consumes less power than LoRa
(d) LoRa supports cellular networks.

- (viii) Which layer in IIoT is responsible for managing and securing industrial assets? **
 (a) Application Layer (b) Asset Layer
 (c) Security Layer (d) Physical Layer.
- (ix) What is a major role of business analytics in IIoT?
 (a) Controlling industrial machines directly
 (b) Optimizing business operations using data-driven insights
 (c) Managing power consumption of devices
 (d) Providing low-level network security.
- (x) What is the biggest advantage of using LoRa over Wi-Fi in IIoT applications?
 (a) Higher bandwidth
 (b) Lower latency
 (c) Lower power consumption and longer range
 (d) Better support for video streaming.

Fill in the blanks with the correct word

- (xi) Unlike HTTP, MQTT and CoAP are preferred in IIoT due to lower _____.
- (xii) The IEEE standard for ZigBee is _____.
- (xiii) LoRaWAN operates in the _____ spectrum.
- (xiv) XaaS in cloud computing stands for _____ as a Service.
- (xv) A fog computer processes data closer to the _____ before cloud transmission.

Group - B

2. (a) Explain the key differences between IIoT and traditional IoT. [[C01](Understand/LOCQ)]
 (b) Describe the architecture of IIoT with a diagram. Explain the role of sensors, edge devices, gateways, and cloud computing. [[C02](Remember/LOCQ)]
 (c) Compare IT and OT infrastructure in an IIoT framework. How does their integration impact industrial automation? [[C01](Analyse/IOCQ)]

$$4 + (2 + 2) + (2 + 2) = 12$$

3. (a) How does predictive maintenance work in IIoT? Explain with an example. [[C03](Remember/LOCQ)]
 (b) Explain the role of fog computing in IIoT and compare it with edge computing. [[C01](Create/HOCQ)]
 (c) How does IIoT help in supply chain optimization? Discuss with an example. [[C02](Remember/LOCQ)]
 (d) Describe the business benefits of IIoT adoption in manufacturing industries. [[C02](Remember/LOCQ)]

$$(2 + 2) + 2 + (2 + 2) + 2 = 12$$

Group - C

4. (a) Describe the various wireless communication protocols used in IIoT. [[C03](Create/HOCQ)]

- (b) Compare ZigBee and Bluetooth for industrial communication. Which one is more suitable for IIoT? [[C04](Evaluate/HOCQ)]
- (c) Describe the publish-subscribe architecture used in MQTT and its advantages. [[C02](Create/HOCQ)]
- (d) What are the advantages of LPWAN technologies in IIoT? [[C02](Remember/LOCQ)]
- 3 + 3 + 3 + 3 = 12**
5. (a) Discuss the role of software-defined networking (SDN) in IIoT. How does it optimize industrial network management? [[C03](Analyse/HOCQ)]
- (b) Explain the importance of real-time scheduling in IIoT wireless networks. [[C04](Remember/LOCQ)]
- (c) Evaluate the future of wireless communication in IIoT. What are the emerging trends and potential advancements in industrial networking? [[C02](Remember/LOCQ)]
- (d) Evaluate the significance of 5G technology in IIoT applications. [[C02](Apply/IOCQ)]
- (2 + 2) + 2 + (2 + 2) + 2 = 12**

Group - D

6. (a) Analyze the major cybersecurity threats in IIoT networks. [[C03](Apply/IOCQ)]
- (b) Explain the various encryption techniques used in IIoT for securing data transmission. How do they contribute to system integrity and confidentiality? [[C04](Apply/IOCQ)]
- (c) Evaluate the role of TLS/SSL in MQTT-based IIoT communications. How does it enhance data security and prevent unauthorized access? [[C05](Apply/IOCQ)]
- (d) Discuss the significance of block-chain technology in securing IIoT applications. [[C02](Remember/LOCQ)]
- 2 + (2 + 2) + (2 + 2) + 2 = 12**
7. (a) Compare the security benefits of fog computing and cloud computing in IIoT. Which approach is more effective in reducing cyber risks? [[C05](Remember/LOCQ)]
- (b) Analyze the major data privacy challenges in IIoT cloud platforms. [[C04](Remember/LOCQ)]
- (c) What legal and technical measures can be implemented to protect sensitive industrial data? [[C03](Create/HOCQ)]
- (d) Discuss the importance of predictive security monitoring in IIoT. [[C03](Remember/LOCQ)]
- 4 + 2 + 4 + 2 = 12**

Group - E

8. (a) Discuss the role of IIoT in aviation and aerospace. [[C03](Analyse/HOCQ)]
- (b) Explain the role of the value chain in IIoT. How does it facilitate the transformation from raw sensor data to actionable insights? [[C04](Remember/LOCQ)]
- (c) Compare the traditional M2M value chain with the modern IIoT value chain. How has the shift to an information-driven value chain impacted industrial processes? [[C06](Remember/LOCQ)]
- (d) Discuss the concept of open data in IIoT value chains. [[C06](Understand/LOCQ)]
- 2 + 4 + 4 + 2 = 12**

9. (a) Explain how IIoT enhances predictive maintenance in industries. What are the key data analytics techniques used in predictive failure analysis? [[C03](Understand/LOCQ)]
- (b) Discuss the applications of IIoT in the energy sector. How does IIoT improve power generation, distribution, and smart grid management? [[C04](Analyse/IOCQ)]
- (c) Compare the role of IIoT in discrete and process manufacturing industries. How do IIoT applications differ in these environments? [[C05](Evaluate/HOCQ)]
- (d) How does sensor-based monitoring help prevent industrial accidents and hazardous exposures? [[C05](Remember/LOCQ)]
- 4 + 3 + 3 + 2 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	55.20	19.80	25